CLAIMS

1-145. Cancelled.

146. A semiconductor light emitting device comprising:

an active layer made of a first nitride III-V compound semiconductor containing In and Ga;

an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor;

a cap layer in contact with the intermediate layer and made of a third nitride III-V compound semiconductor containing Al and Ga; and

a p-type clad layer on the cap layer.

147. The semiconductor light emitting device according to claim 146 wherein the second nitride III-V compound semiconductor composing the intermediate layer is $In_xGa_{1-x}N$ (where $0 \leq x < 1$).

148. The semiconductor light emitting device according to claim 146 wherein the third nitride III-V compound semiconductor composing the cap layer is $Al_yGa_{1-y}N$ (where $0 \leq y < 1$).

149. The semiconductor light emitting device according to claim 146 further comprising a p-type layer of a fourth nitride III-V compound semiconductor containing Ga in contact with the cap layer.

150. The semiconductor light emitting device according to claim 149 wherein the fourth nitride III-V compound semiconductor composing said p-type layer is GaN.

151. The semiconductor light emitting device according to claim 149 wherein the fourth nitride III-V compound semiconductor composing said p-type layer is $In_zGa_{1-z}N$ (where $0 \leq z < 1$).

152. The semiconductor light emitting device according to claim 146 wherein the active layer has a multi-quantum well structure including well layers and barrier layers, and composition of In in the intermediate layer is equal to or smaller than composition of In in the barrier layers.

153. The semiconductor light emitting device according to claim 146 wherein composition of In in the second nitride III-V compound semiconductor composing the intermediate layer decreases toward a portion thereof remotest from the active layer.

154. The semiconductor light emitting device according to claim 146 wherein quantity of In contained in the intermediate layer is equal to or less than $5\times10^{19}cm^{-3}$.

155. The semiconductor light emitting device according to claim 1 wherein thickness of the intermediate layer is equal to or more than 8 nm.

156. The semiconductor light emitting device according to claim 146 wherein quantity of In contained in said p-type layer is not less than $1\times10^{17}cm^{-3}$ and not more than $5\times10^{19}cm^{-3}$.

157. The semiconductor light emitting device according to claim 146 wherein said p-type layer is an optical guide layer.

158. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor; a cap layer in contact with the intermediate layer and made of a third nitride III-V compound semiconductor containing Al and Ga; and a p-type clad layer on the cap layer, comprising:

growing the intermediate layer while raising the growth temperature after growing the active layer.

159. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein the growth temperature upon completion of the growth of the intermediate layer is equal to the growth temperature of the cap layer.

160. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein the second nitride III-V compound semiconductor composing the intermediate layer is $In_xGa_{1-x}N$ (where $0\leq x<1$).

161. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein the third nitride III-V compound semiconductor composing the cap layer is $Al_yGa_{1-y}N$ (where $0\leq y<1$).

162. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein the semiconductor light emitting device further includes a p-type layer of a fourth nitride III-V compound semiconductor containing Ga in contact with the cap layer.

163. The manufacturing method of a semiconductor light emitting device according to claim 162 wherein the fourth nitride III-V compound semiconductor composing said p-type layer is GaN.

164. The manufacturing method of a semiconductor light emitting device according to claim 162 wherein the fourth nitride III-V compound semiconductor composing said p-type layer is $In_zGa_{1-z}N$ (where $0 \leq z < 1$).

165. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein the active layer has a multi-quantum well structure including well layers and barrier layers, and composition of In in the intermediate layer is equal to or smaller than composition of In in the barrier layers.

166. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein composition of In in the second nitride III-V compound semiconductor composing the intermediate layer decreases toward a portion thereof remotest from the active layer.

167. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein quantity of In contained in the intermediate layer is equal to or less than $5 \times 10^{19} cm^{-3}$.

168. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein thickness of the intermediate layer is equal to or more than 8 nm.

169. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein quantity of In contained in said p-type layer is not less than $1 \times 10^{17} cm^{-3}$ and not more than $5 \times 10^{19} cm^{-3}$.

170. The manufacturing method of a semiconductor light emitting device according to claim 158 wherein said p-type layer is an optical guide layer.

171. A semiconductor light emitting device comprising:

an active layer made of a first nitride III-V compound semiconductor containing In and Ga;

an optical guide layer in contact with the active layer and made of a sixth nitride III-V compound semiconductor containing Ga;

a cap layer in contact with the intermediate layer and made of a third nitride III-V compound semiconductor containing Al and Ga; and

a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor.

172. The semiconductor light emitting device according to claim 171 wherein the cap layer has a band gap larger than that of the p-type clad layer.

173. The semiconductor light emitting device according to claim 171 wherein the third nitride III-V compound semiconductor composing the cap layer is $Al_yGa_{1-y}N$ (where $0 \leq y < 1$).

174. The semiconductor light emitting device according to claim 171 wherein thickness of the cap layer is equal to or more than 2 nm.

175. The semiconductor light emitting device according to claim 171 wherein the optical guide layer is undoped.

176. The semiconductor light emitting device according to claim 171 wherein thickness of the optical guide layer is equal to or more than 8 nm.

177. A semiconductor light emitting device comprising:

an active layer made of a first nitride III-V compound semiconductor containing In and Ga;

an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor;

an optical guide layer in contact with the intermediate layer and made of a sixth nitride III-V compound semiconductor containing Ga;

a cap layer in contact with the optical guide layer and made of a third nitride III-V compound semiconductor containing Al and Ga; and

a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor.

178. The semiconductor light emitting device according to claim 177 wherein the cap layer has a band gap larger than that of the p-type clad layer.

179. The semiconductor light emitting device according to claim 177 wherein the second nitride III-V compound semiconductor composing the intermediate layer is $In_xGa_{1-x}N$ (where $0 \leq x < 1$).

180. The semiconductor light emitting device according to claim 177 wherein the third nitride III-V compound semiconductor composing the cap layer is $Al_yGa_{1-y}N$ (where $0 \leq y < 1$).

181. The semiconductor light emitting device according to claim 177 wherein thickness of the cap layer is equal to or more than 2 nm.

182. The semiconductor light emitting device according to claim 177 wherein the optical guide layer is undoped.

183. The semiconductor light emitting device according to claim 177 wherein thickness of the optical guide layer is equal to or more than 8 nm.

184. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an optical guide layer in contact with the active layer and made of a sixth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the optical guide layer and made of a third nitride III-V compound semiconductor containing Al and Ga; and a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the optical guide layer and the cap layer in a carrier gas atmosphere containing substantially no hydrogen and containing nitrogen as the major component thereof; and

growing the p-type clad layer in a carrier gas atmosphere containing nitrogen and hydrogen as major components thereof.

185. The manufacturing method of a semiconductor light emitting device according to claim 184 wherein the carrier gas atmosphere containing substantially no hydrogen and containing nitrogen as the major component thereof is a N_2 gas atmosphere.

186. The manufacturing method of a semiconductor light emitting device according to claim 184 wherein the carrier gas atmosphere containing nitrogen and hydrogen as major components thereof is a mixed gas atmosphere of N_2 and H_2.

187. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an optical guide layer in contact with the active layer and made of a sixth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the optical guide layer and made of a third nitride III-V compound semiconductor containing

Al and Ga; and a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the optical guide layer and the cap layer at a growth temperature lower than the growth temperature of the p-type clad layer.

188. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor; an optical guide layer in contact with the intermediate layer and made of a sixth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the optical guide layer and made of a third nitride III-V compound semiconductor containing Al and Ga; and a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the intermediate layer, the optical guide layer and the cap layer in a carrier gas atmosphere containing substantially no hydrogen and containing nitrogen as the major component thereof; and

growing the p-type clad layer in a carrier gas atmosphere containing nitrogen and hydrogen as major components thereof.

189. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor; an optical guide layer in contact with the intermediate layer and made of a sixth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the optical guide layer and made of a third nitride III-V compound semiconductor containing Al and Ga; and a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the intermediate layer, the optical guide layer and the cap layer at a growth temperature lower than the growth temperature of the p-type clad layer.

190. The manufacturing method of a semiconductor light emitting device according to claim 189 wherein the active layer and the intermediate layer are grown at a growth temperature lower than the growth temperature of the optical guide layer and the cap layer.

191. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; a first optical guide layer in contact with the active layer and made of an eighth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the first optical guide layer and made of a third nitride III-V compound semiconductor containing Al and Ga; a second optical guide layer in contact with the cap layer and made of a ninth nitride III-V compound semiconductor containing Ga; and a p-type clad layer in contact with the second optical guide layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the first optical guide layer and the cap layer in a carrier gas atmosphere containing substantially no hydrogen and containing nitrogen as the major component thereof; and

growing the second optical guide layer and the p-type clad layer in a carrier gas atmosphere containing nitrogen and hydrogen as major components thereof.

192. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; a first optical guide layer in contact with the active layer and made of an eighth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the first optical guide layer and made of a third nitride III-V compound semiconductor containing Al and Ga; a second optical guide layer in contact with the cap layer and made of a ninth nitride III-V compound semiconductor containing Ga; and a p-type clad layer in contact with the second optical guide layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the first optical guide layer and the cap layer at a growth temperature lower than the growth temperature of the second optical guide layer and the p-type clad layer.

193. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor; a first optical guide layer in contact with the intermediate layer and made of an eighth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the first optical guide layer and made of a third nitride III-V compound semiconductor containing Al and Ga; a second optical guide layer in contact with the cap layer and made of a ninth nitride III-V compound semiconductor containing Ga; and a p-type clad layer in contact with the second optical guide layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the intermediate layer, the first optical guide layer and the cap layer in a carrier gas atmosphere containing substantially no hydrogen and containing nitrogen as the major component thereof; and

growing the second optical guide layer and the p-type clad layer in a carrier gas atmosphere containing nitrogen and hydrogen as major components thereof.

194. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor; a first optical guide layer in contact with the intermediate layer and made of an eighth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the first optical guide layer and made of a third nitride III-V compound semiconductor containing Al and Ga; a second optical guide layer in contact with the cap layer and made of a ninth nitride III-V compound semiconductor containing Ga; and a p-type clad layer in contact with the second optical guide layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the intermediate layer, the first optical guide layer and the cap layer at a growth temperature lower than the growth temperature of the second optical guide layer and the p-type clad layer.

195. The manufacturing method of a semiconductor light emitting device according to claim 194 wherein the active layer is grown at a growth temperature lower than that of the intermediate layer, the first optical guide layer and the cap layer.

196. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; a first optical guide layer in contact with the active layer and made of an eighth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the first optical guide layer and having a superlattice structure in which barrier layers are made of a third nitride III-V compound semiconductor containing Al and Ga; a second optical guide layer in contact with the cap layer and made of a ninth nitride III-V compound semiconductor containing Ga; and a p-type clad layer in contact with the second optical guide layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the first optical guide layer and the cap layer in a carrier gas atmosphere containing substantially no hydrogen and containing nitrogen as the major component thereof; and

growing the second optical guide layer and the p-type clad layer in a carrier gas atmosphere containing nitrogen and hydrogen as major components thereof.

197. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; a first optical guide layer in contact with the active layer and made of an eighth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the first optical guide layer and having a superlattice structure in which barrier layers are made of a third nitride III-V compound semiconductor containing Al and Ga; a second optical guide layer in contact with the cap layer and made of a ninth nitride III-V compound semiconductor containing Ga; and a p-type clad layer in contact with the second optical guide layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the first optical guide layer and the cap layer at a growth temperature lower than the growth temperature of the second optical guide layer and the p-type clad layer.

198. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor; a first optical guide layer in contact with the intermediate layer and made of an eighth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the first optical guide layer and having a superlattice structure in which barrier layers are made of a third nitride III-V compound semiconductor containing Al and Ga; a second optical guide layer in contact with the cap layer and made of a ninth nitride III-V compound semiconductor containing Ga; and a p-type clad layer in contact with the second optical guide layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the intermediate layer, the first optical guide layer and the cap layer in a carrier gas atmosphere containing substantially no hydrogen and containing nitrogen as the major component thereof; and

growing the second optical guide layer and the p-type clad layer in a carrier gas atmosphere containing nitrogen and hydrogen as major components thereof.

199. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor; a first optical guide layer in contact with the intermediate layer and made of an eighth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the first optical guide layer and having a superlattice structure in which barrier layers are made of a third nitride III-V compound semiconductor containing Al and Ga; a second optical guide layer in contact with the cap layer and made of a ninth nitride III-V compound semiconductor containing Ga; and a p-type clad layer in contact with the second optical guide layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the intermediate layer, the first optical guide layer and the cap layer at a growth temperature lower than the growth temperature of the second optical guide layer and the p-type clad layer.

200. The manufacturing method of a semiconductor light emitting device according to claim 54 wherein the active layer and the intermediate layer are grown at a growth temperature lower than that of the first optical guide layer and the cap layer.

201. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an optical guide layer in contact with the active layer and made of a sixth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the optical guide layer and having a superlattice structure in which barrier layers are made of a third nitride III-V compound semiconductor containing Al and Ga; and a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the optical guide layer and the cap layer in a carrier gas atmosphere containing substantially no hydrogen and containing nitrogen as the major component thereof; and

growing the p-type clad layer in a carrier gas atmosphere containing nitrogen and hydrogen as major components thereof.

202. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an optical guide layer in contact with the active layer and made of a sixth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the optical guide layer and having a superlattice structure in which barrier layers are made of a third nitride III-V compound semiconductor containing Al and Ga; and a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the optical guide layer and the cap layer at a growth temperature lower than the growth temperature of the p-type clad layer.

203. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor; an optical guide layer in contact with the intermediate layer and made of a sixth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the optical guide layer and having a superlattice structure in which barrier layers are made of the third nitride III-V compound semiconductor containing Al and Ga; and a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the intermediate layer, the optical guide layer and the cap layer in a carrier gas atmosphere containing substantially no hydrogen and containing nitrogen as the major component thereof; and

growing the p-type clad layer in a carrier gas atmosphere containing nitrogen and hydrogen as major components thereof.

204. A manufacturing method of a semiconductor light emitting device including an active layer made of a first nitride III-V compound semiconductor containing In and Ga; an intermediate layer in contact with the active layer and made of a second nitride III-V compound semiconductor containing In and Ga and different from the first nitride III-V compound semiconductor; an optical guide layer in contact with the intermediate layer and made of a sixth nitride III-V compound semiconductor containing Ga; a cap layer in contact with the optical guide layer and having a superlattice structure in which barrier layers are made of the third nitride III-V compound semiconductor containing Al and Ga; and a p-type clad layer in contact with the cap layer and made of a seventh nitride III-V compound semiconductor containing Al and Ga and different from the third nitride III-V compound semiconductor, comprising:

growing the active layer, the intermediate layer, the optical guide layer and the cap layer at a growth temperature lower than the growth temperature of the p-type clad layer.

205. The manufacturing method of a semiconductor light emitting device according to claim 204 wherein the active layer and the intermediate layer are grown at a growth temperature lower than that of the first guide layer and the cap layer.